U. S. FOREST SERVICE

RESEARCH NOTE NC-83

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

Folwell Avenue, St. Paul, Minnesota 55101

# THE GERMINATION OF SEVERAL TREE SPECIES IN PLASTIC GREENHOUSES

**ABSTRACT. — The technique of growing tree seedlings in plastic greenhouses is being evaluated for red pine, jack pine, white spruce, and yellow birch at the Chittenden Nursery in northern Lower Michigan. Both a long growing season and a normal-length growing season in plastic greenhouses were compared with standard outdoor nursery beds (control). First-year results showed that germination and survival of red pine and jack pine were significantly higher in the greenhouses than in the control. Also, for red pine, the long growing season was superior to the other greenhouse treatments and the control. Results with white spruce and yellow birch were variable and differences between greenhouse treatments and the control were not statistically significant.**

**OXFORD: 232.329.1:U678.5:181.525**

Researchers in northern Europe have found that plastic greenhouses substantially increase germination and growth of forest-tree seedlings. Nursery managers in Finland have been able to reduce production time for pine and fir by 1 year with this method[1,2]. As the first step in evaluating this technique for growing red pine, jack pine, yellow birch, and white spruce at the Chittenden Nursery in northern Lower Michigan, we compared first-year germination and survival of seedlings grown under the following conditions: (1) a long growing season under plastic, (2) a normal-length growing season (with and without supplemental heat) under plastic, and (3) standard outdoor nursery beds.

The greenhouses measured 16 x 20 x 8 feet, and had a door with a transom vent near the top at each end (fig. 1). The area within each greenhouse was divided into four seedbeds of equal size, and each species was randomly assigned to one of the beds. The greenhouse frameworks were erected in the fall but were not covered with plastic until spring. Seed was broadcast sown in the fall on ordinary nursery soil with a small fertilizer-seed spreader at a rate that produces about 35 seedlings per square foot under standard nursery conditions.

F-519458

Figure 1. — View of greenhouses with vents open. Irrigation line in foreground was used for watering greenhouse and control seedbeds.

[1] *Bergman, F., and Leskinen, U. Plant production under plastic. Skogen. 50:216-291. 1963.*

[2] *Bergman, F., and Leskinen, U. Production de plants forestiers sous plastique en Suede. Pepinieristes Hort. Maraichers 46: 1929-1935. 1964.*

The following treatments in a randomized block design with two replications were initiated the next spring: (1) long season — greenhouses were covered March 1 with ultraviolet-resistant polyethylene and heated with an electric heater to maintain a minimum temperature of 45° F.; (2) normal season (heated) — greenhouses were covered with polyethylene when germination began (about May 1), and heated as above; (3) normal season (unheated) — same as above except no artificial heat was used; (4) control — standard outdoor nursery beds.

About 1 foot of snow was on the ground when the greenhouses were covered for the long-season treatments on March 1, but it melted completely after about a week. All species began germinating in this treatment by March 29. All species were germinating in the remaining seedbeds by May 1, and the normal-season greenhouses were then covered. On clear summer days the vents in the greenhouses were opened to reduce heat buildup. Nevertheless, air temperature in the greenhouses exceeded 100° F. several times during the summer. Soil temperature in the greenhouses ½-inch beneath the surface averaged 5 to 10 degrees higher than outside. In late September the plastic covers and electric heaters were removed.

Live seedlings were counted on randomly selected plots in all treatments and replications 2, 4, and 6 weeks after germination began, and again in the fall when the plastic was removed. Initial germination was highest in the long-season treatment, and this treatment maintained the greatest number of seedlings throughout the growing season. Seedling germination differences between the heated and unheated normal-season greenhouse treatments were insignificant. By the end of the season the greenhouse treatments had produced a greater number of seedlings per square foot than the control for all species (table 1). However, the differences were statistically significant (at the .05 level) only for jack pine and red pine. Also, the long-season treatment resulted in a significantly greater number (.05 level) of red pine seedlings than any of the other treatments. Mortality did not appear to be affected by treatment except in the case of yellow birch, where more seedlings died in the greenhouses than in the control.

The results of this study showed that plastic greenhouses can be used to obtain greater first-year germination and survival for jack pine and red pine than standard outdoor nursery beds. The technique could be especially useful for growing stock from high-value seed, such as hybrid or superior-tree seed.

Table 1.— *Average number of live seedlings per square foot by treatment, September 20, 1968*

| Species | Greenhouse treatment | | | Control |
|---|---|---|---|---|
| | Long season | Normal season (heated) | Normal season (unheated) | |
| Red pine | 32.4 | 12.3 | 14.4 | 4.5 |
| Jack pine | 43.7 | 30.8 | 26.0 | 13.2 |
| White spruce | 39.9 | 24.2 | 18.5 | 13.7 |
| Yellow birch | 37.1 | 31.2 | 28.2 | 9.2 |

HOWARD M. PHIPPS
Associate Plant Physiologist
East Lansing, Michigan
(Field office maintained in cooperation with Michigan State University)